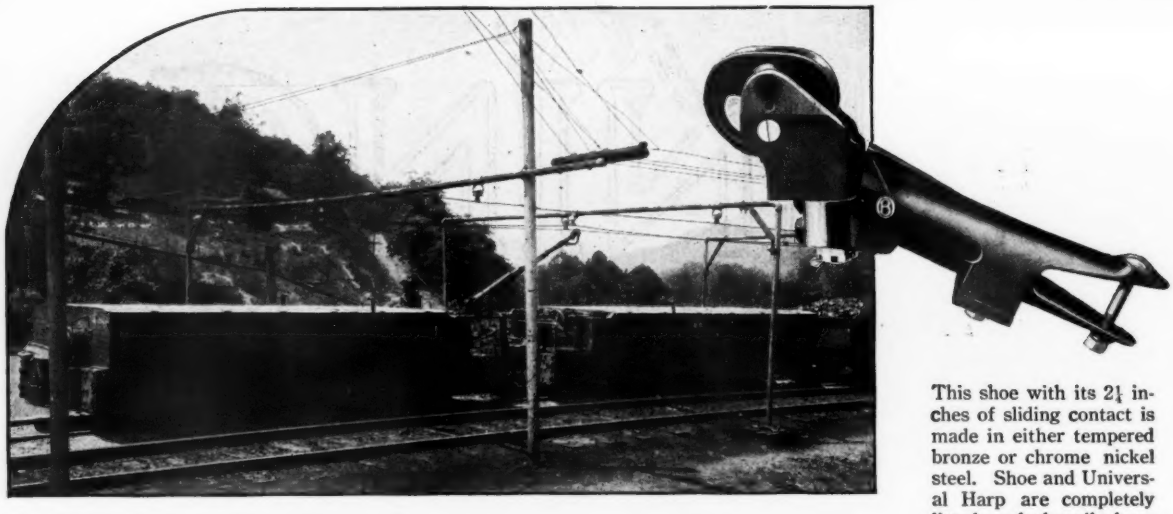
The MINING CONGRESS JOURNAL

JULY ● AUGUST

1932



This shoe with its 2¼ inches of sliding contact is made in either tempered bronze or chrome nickel steel. Shoe and Universal Harp are completely listed and described on page 43, O-B New Products Supplement No. 4.

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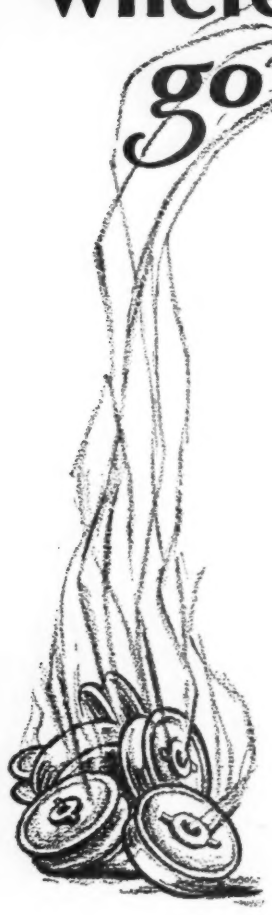

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THE MINING CONGRESS JOURNAL

VOLUME 18, NUMBER 8

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1932

Published every month by The American Mining Congress, Washington, D. C. Edited under the supervision of James F. Callbreath, Secretary of The American Mining Congress.

Entered as Second Class Mail Matter January 30, 1915, at the Post Office at Washington, D. C. Published 13 times annually—the first of each month and the 15th of September. Yearly subscription, United States and Canada, $3.00; Foreign, $4.00; single copies, $0.50.

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THE MINING CONGRESS JOURNAL

A Journal for the entire mining industry
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Representative Government

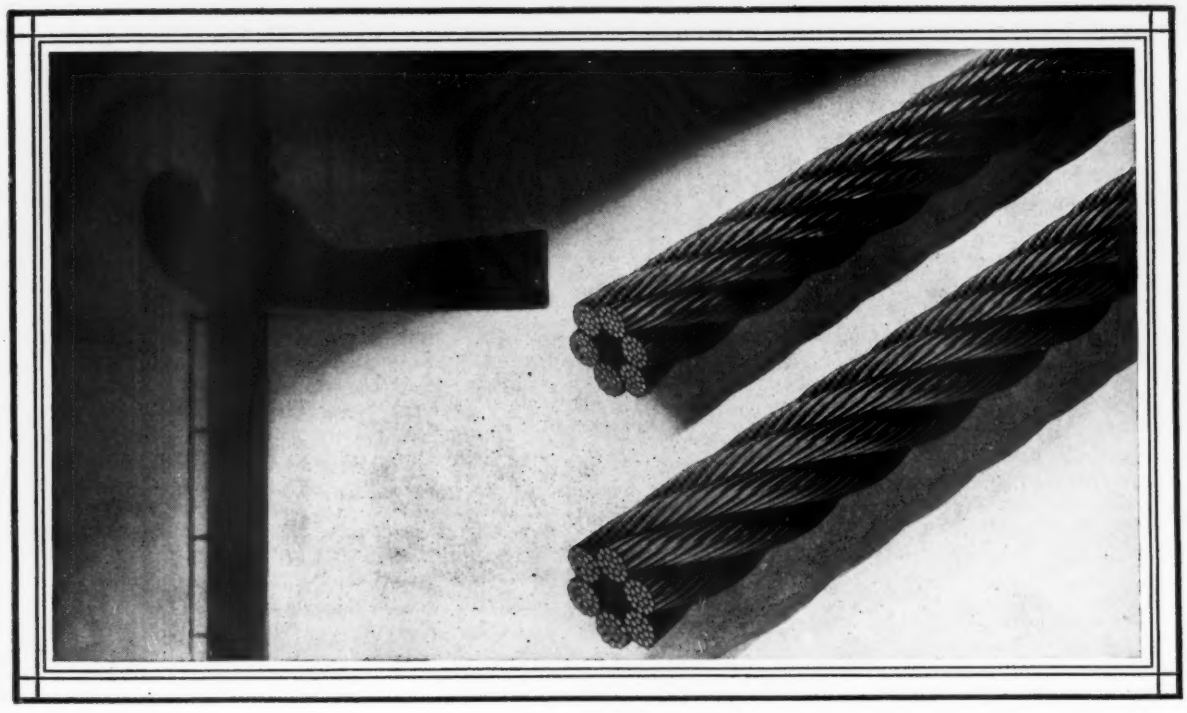
IN AN address before the American Chamber of Commerce, in London, Mr. H. Gordon Selfridge (American born department store owner) said, "I came back from the United States strengthened in my belief that Democracy as a system of government is an absolute failure. It can not possibly succeed in a great country where there are a great many people. Democracy never inspires, never does anything on its own accord, never assists, hinders wherever it can, always holds back. In my judgment, control of a country by an inspiring spirit without selfishness, managing the country as a great business is managed, with intelligence and care, is what must come eventually."

As applied to a pure democracy this statement may have merit. But he who regards the American Government as a democracy has not studied its fundamental principles. This is a representative government. It speaks the will of its masses through representatives chosen by them. Its every official from the President down to the Justice of the Peace in a rural neighborhood has his duties assigned to him either in the Constitution or in laws provided thereunder. Each serves for a definite term at the end of which, if his performance is not satisfactory to the people whom he represents, he may be replaced with someone who seems more likely to meet their wishes.

Mr. Selfridge's comments are based upon an improper conception of our form of government and his conclusions are reached during a period of stress in which the best thought and the most patriotic impulses are essential to enable this or any other government to survive. Reliance, as Mr. Selfridge suggests, upon a "leader to inspire, somebody who is going to do the thinking while we attend to our own affairs" does not seem to have worked out well with other forms of government. Many monarchies have toppled and their peoples have striven to emulate the United States in a form of government which, whether permanent or not, has during the years brought about more of those things which make for happiness and progress than any other thus far devised in the world's history.

A distinguished statesman once said, "Eternal vigilance is the price of liberty." The exercise of this eternal vigilance is more clearly required at this time than ever before. We must guard and protect the representative government provided for in our Constitution. We must make a united stand against government by coercion. We must stand against those agencies which appeal to Congress with threats of political retribution to those who fail to surrender to their demands. We must not permit the demand either of mobs or of organized minorities to influence the judgment of our representatives. Every effort to influence legislation by coercion, threats or reprisal is an insidious danger. Every effort should be made to supply legislative bodies with all of the facts pertaining to any legislation, which affects the public welfare. No Congressman or Senator can even pretend to be thoroughly acquainted with every phase of the thousands of lines of business which are carried on by the citizens of a great nation. The success of these various industries, small or large, is the success of the nation and necessary to the welfare of all of its people. Those agencies which bring to Congress information concerning any legislative act affecting that industry are serving a highly useful purpose. Any effort by any agency to induce any representative to deviate from the exercise of his own best judgment, based upon facts, is a danger to representative government and should be discouraged by every possible means. Any agency which couples its request for legislative action with a statement of the number of voters it represents, is striking at the roots of representative government. Any organization which by force of numbers charges upon the capitol to awe the representatives of the people is committing a most serious assault upon representative government. We must learn that having exercised our privilege and our duty to vote for the different officials of government, that whether our candidate shall be elected or not, he who is elected is officially required to exercise his own good judgment, based upon the facts involved, in every act of his legislative career and that he who allows himself to be swerved from that course is unfit for his position. The great mass of people who remain at home are entitled to the benefit of the best judgment and discretion of him who received a majority of the votes in the district from which he was elected.

Let us beware of the activities of those who seek to coerce legislators and let us remember that good citizenship requires that every citizen shall cast his vote and that whether on the winning or losing side he shall respect the action of the representatives so chosen as the will of the people, upon which foundation rests the Government of the United States.



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The MINING CONGRESS JOURNAL

JULY-AUGUST
1932
VOLUME 18
NUMBER EIGHT

Editorials

Pricing for Profit

IT HAS LONG been our contention that but one thing is necessary to stabilize and make profitable the coal mining business and that is that no coal should be sold except at a profit and that no considerable amount of coal should be mined except after it had been sold. A recent book by W. L. Churchill entitled, "Pricing for Profit," adds a unique aspect to this question. Mr. Churchill believes that the first duty of the managers of a corporation or business is to make a profit for its stockholders or owners; that the chief reason for the existence of business is to earn profits; that it is not the purchasing agent who is responsible for the breakdown of price levels so much as the producer through attempts to increase volume in order to cut overhead costs. This process in the end effects the demoralization of the market and injures all competitors and at the same time wastes the profits for the earning of which the business was organized.

We commend a perusal of Mr. Churchill's book.

Tax Burdens

IN THESE days of increasing taxation burdens which fall particularly heavy during times of business depression, it may be well to renew our consideration of the policy of federal aid to enterprise in cooperation with the various States.

The primary objection to this principle lies in the fact that the States are induced through this proposal to raise money for enterprises which would not be justified, or at least they would not be willing to undertake, if the whole cost was to be borne by the State itself.

A second and forceful objection is that it leads to a further increase in the activities of the Federal government.

These two objections should be sufficient to demand careful scrutiny not only of these two objections, but of the general effect of these operations as relating to autonomy of the several States. The greater part of every dollar spent by governmental authorities—State or national—will fall eventually upon the State.

Mr. Coolidge, in a recent magazine article, intimates that the burdens of taxation are responsible for our present business depression, and insists that "the only relief from high taxes is a reduction in public expenditures." The burdens of local taxation in many instances are so great as to make it unprofitable to own property. Unless buildings can be so rented as to cover the cost of administration, taxation and depreciation, new building enterprises will be discontinued. Those employed in building enterprises will be without work. They will necessarily become a charge against some other industry or against the public at large and the circle will be ever widening in its restricting effect upon business.

If the Federal government is to continually expand its expenditures it will be obliged to enter fields of taxation heretofore regarded as entirely the prerogative of the several States. The effort to put a tax on gasoline by the Federal government is an indication of this tendency.

The inducement of public improvements at one-half the cost to the several States will continue to lead the States to undertake enterprises which while valuable in themselves are not justified during time of business depression. When people begin to realize that every public luxury costs the community which enjoys it very much more under Federal than under local management, there will be a more general effort to prevent joint cooperation between State and Nation in the development of public improvments, which so add to the local burdens as to make business investments unprofitable.

Not the Time For Useless Investigation

THE Rules Committee of the House of Representatives has suspended action on the resolution calling for an investigation of the Treasury Department until the winter term of Congress. It is regrettable that the administration of the none too well written Revenue Act should be complicated by the sacrifice of energy on the part of the devoted employes of the Treasury Department which will be inevitable in the event of a further Congressional investigation.

No layman has any idea of the technicalities involved in the administration of our revenue law. One item alone—that of the appraisal of property—is bringing forth a problem which in itself calls for a terrific output of effort on the part of the best minds in this undermanned and overworked Government activity. Coupled with the problems of the past, we now have the imperative call upon the Treasury Department through the Bureau of Internal Revenue and Income Tax Unit for the development of Regulations under which the new Revenue Act must be administered.

The solution of the problem of tax taking in the matter of the electrical energy tax alone is a stupendous work, calling for effort far in excess of anything normally witnessed in the conduct of personal or corporate enterprises.

Ample provision is made for the guarding of the interest of the people in the creation of the Congressional Joint Committee on Internal Revenue Taxation. This committee is composed of five ranking members each from the Ways and Means Committee of the House of Representatives from the Finance Committee of the Senate. The committee has a staff of specialists through which investigation may be carried on to the most minute detail and in an orderly and regular manner and at a minimum of cost as compared with the creation of some further investigating committee or commission. Any investigation desired on the part of any member of Congress may and should be referred to the Joint Committee on Internal Revenue Taxation which is evenly divided in number in the matter of the two political parties and which is made up of men of tried and proven ability.

The Trend in Mining Research

by Philip B. Bucky*

In this paper the term Mining Research is limited to mean an investigation for determining the facts and principles relating to the behavior of the orebody and the surrounding material when put under the stresses caused by making the excavations incident upon mining operations.

To be successful, a research process must have the following qualifications:

(1) The process must be comparatively cheap.
(2) The time element must be small.
(3) Control of each element that may affect the results must be obtained.
(4) The results should be of reasonable accuracy.

Research in certain branches of chemistry and metallurgy may readily be performed where all of the above conditions are met. The chemist works with test tubes and solutions; the metallurgist with crucibles, metals and heat. Their methods of measurement are accurate, and they are fairly certain of the principles of similarity, by which is meant the ratio existing between the relatively small-scale work of the laboratory and the large quantities dealt with in field practice. In metallurgy the question of similarity is important, since ore roasting results in a small furnace may not compare accurately on a weight basis with those in a large furnace, unless certain conditions in the furnace and ore are properly controlled.[1]

The advantages of this type of research may be summed up as follows:

(1) Anyone having the necessary background, as an investigator, may try out his idea with small expense of time and money.
(2) Problems of importance to the industry as a whole may be attacked in any number of laboratories.
(3) The results of experiment are sufficiently conclusive to furnish a logical basis for acceptance or rejection.

Mining research, as defined above, lacks some of the facilities possessed by chemical and metallurgical engineers. We have thus far had no means of conducting the work on a scale small enough to be tried in a laboratory with a comparatively small expenditure of time and money. Our experimental work has been on a grand basis, that is, ideas have been tried in the field on a large scale and with large expenditures of time and money. While it is impossible to ascertain the expenditures that have been made for mining research it is fairly safe to say that it compares favorably with that spent in other fields.

Mining engineers determine the effect of a certain opening on the ore and the surrounding rock by actually making the excavation, at large expense of time and money. Even though certain data are well known in one district, their application to the conditions existing in another district may be very questionable. We are concerned with many factors, including the nature and character of the overburden, cleavage, fault planes, dip of bed, surface topography, size of opening, etc. Research will probably show that some factors considered of major importance are really not so, and that other factors have an effect opposite to the present accepted thought. Laboratory researches still unpublished have shown that fault planes under certain conditions do not materially affect the ability of an opening to stand up; also that in solid rock the greater the depth of cover the larger the opening may safely be.

In searching for means of attacking mining problems, the application of the principles of mechanics offers great possibilities. Mining excavations involve the principles of modified beams and columns, but, while the behavior of these have been fairly well determined in mechanics, those generally dealt with in mining are less definite in character. Furthermore, mechanics is based on the behavior of materials stressed within the elastic limits, i. e., stressed so that when the load is removed the structure assumes its original shape, while in mining the materials are generally stressed beyond the elastic limits. This is self-evident in the case of a caving method.

The problem then of the mining engineer is to ascertain the truth regarding the behavior of mine structures. What was once an all inclusive profession now finds itself in serious competition with experts on geology, hoisting, haulage, drainage, ventilation, ore dressing, accounting and metallurgy. If the profession and industry will realize that the behavior and control of mining structures is one of the major problems of the profession, much will have been done to advance knowledge along those lines.

Hydraulic and aeronautical engineers are confronted with problems as difficult to handle as those of mining engineers, and yet they have accomplished much by means of laboratory experiment. For example, hydraulic engineers have dealt successfully in the laboratory with problems of river and flood control, harbor design, etc.

J. R. Freeman, an eminent hydraulic engineer, in Hydraulic Laboratory Practice,[2] says:

"You may possibly believe that the fundamental science and data of hydraulics have been sufficiently worked out but as a matter of fact there are only five classes of problems that can be estimated with an error not exceeding from 2 to 20 percent. The solution of the above five classes of problems fail utterly to meet the needs of river and harbor engineering and the needs of modern engineers in other lines of work. The hydraulic engineers have been fairly successful in working some of their problems by means of models and the application of the principles of similarity."

Mr. Freeman defines the principle of hydraulic similitude as "that controlling the behavior of a current of water in relation to the channel through which it flows, by reason of which this behavior will be relatively in a large water course or structure as that found in a small model of it made with every corresponding dimension accurately to scale."

The principles of similitude may also be defined as those laws (generally ratios) which make it possible to determine the behavior of a full-scale device or structure from the behavior of a model. In mining, these principles have been used and either known by a different name, or not named at all. Most of us are acquainted with the facts of fan and pump performance; that is, knowing the results of a fan or pump of a homologous series, we can determine what a larger or a smaller one will do.

For example, in considering pumps we know that if the speed of the pump is kept constant and the impeller diameter is changed, then:

(1) The quantity of water delivered varies as the diameter. A pump whose impeller diameter is twice that of the model delivers twice the number of gallons of water.
(2) The head varies as the square of the diameter. In other words, the same pump considered in (1) will force water to four times the height.
(3) The power varies as the diameter cubed, which means that the pump considered in (1) and (2) and run at the same speed will require eight times the power of the model.

For mine fans, by applying these laws, if the capacity, pressure and horsepower equivalents of a model fan are known, it is easy to calculate what these factors will be for a fan of a larger size, running at the same or different speed.

In ventilation, the formula $P=\frac{KSV^2}{a}$ may be derived by experiment with different sized and shaped openings and different rates of air flow. Once the general formula is determined, then, by experimenting with various openings in different materials, the values of K may be determined, and thus mine ventilation problems are solved.

* School of Mines, Columbia University.

[1] Contributed in private conversations by Dr Coolbaugh and Prof. Kern.

[2] Hydraulic Laboratory Practice, page 6, by J. R. Freeman. Published in 1929 by the A. S. M. E.

With problems pertaining to the behavior of the ore-body and the surrounding rock when openings are made in them it is generally admitted that of the facts concerning the behavior little is known. Before theories are developed and accepted, much practical experimentation is necessary. By using models, certain ideas may be tested, and if they work, it is as reasonable to assume that they will serve in the field as it is for the chemist to assume that if he performs a test tube experiment in his laboratory it will work on a full size plant scale.

To be of benefit to the mining profession, the general condition to be met is that it must be possible, by the law of similarity, to calculate from the model results what the results will be on the prototype (structure represented). Thus, if the scale is 1 to 100 and the roof in the model subsides .01 in., will the prototype roof subside .01 in., 1 in., or 1 ft? If the surface in the model subsides 0.1 in., what subsidence will this represent in the prototype? Or, if in investigating a caving method, the ore in the model breaks in pieces .01 in. in diameter, what will be the sizes that the ore will break to in the prototype?

By applying the principles of mechanics and mathematics, in Technical Paper 425 of the A. I. M. M. E. are shown several methods of making a model so that what happens in the model will be a scalar representation of what will take place in the field. For example, if the model scale is 1 to 100, then 0.01 in. roof sag in the model would mean a 1-in. roof sag in the field; 0.1 in. of surface subsidence in the model means 10 in. of surface subsidence in the field. Particle sizes of 0.01 in. in the model mean particle sizes of 1-in. size in the field. The other general conditions that should and have been met for model experimentation are:

(1) The model should be a true scalar representation; meaning that all the model dimensions must bear the same relationship to similar prototype dimensions.

(2) The material in the model should be the same as that in the prototype. Although models may be made of different materials, it must be remembered that if they are so made certain qualifications that these materials must satisfy are so difficult to obtain that at present this seems an impossibility.

(3) The model must then be put under such conditions that it will behave like its prototype.

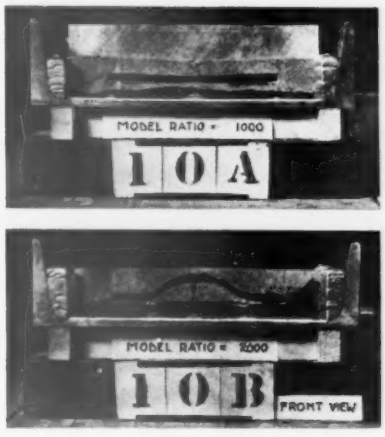
(4) Facilities must be made available for making observations and recording data of the model behavior.

A scalar model built of the same material as its prototype will behave similarly to the prototype if it is rotated in a centrifuge at such a speed that it exerts a force against the end plate of a centrifuge equal to its weight multiplied by the number of times it has been reduced in scale.[3]

To put it another way, if a model made to a 1 to 10 scale and weighing one pound is whirled at such a speed that its pull on a string holding it to the center is 10 pounds, then it will behave like its prototype. The model must be observed while rotating and a record made of what takes place. Two methods have been fairly successfully applied to observation of model behavior while rotating, an intermittent source of light, and a stroboscope.

There is therefore now available a laboratory means of studying the mining problems. It is hoped that as soon as this becomes more generally known and accepted, research in this field will be carried on by many. The theory underlying most mining truths will be found in that branch of physics known as Mechanics and progress will result from contributions to the knowledge of the behavior of materials when stressed beyond the elastic limits. Here lies a distinct challenge to the mining industry and which, if met, can not help but return much of value to everybody concerned.

It is now reasonable to assume that as time goes on the laboratory will become of more importance as a place of studying mining problems. It must be



Photographs showing sandstone model behavior in the centrifuge. All model dimensions are the same except that cover in 10 B is 50 percent greater than in 10 A

agreed upon that we must start from scratch. Questions frequently raised are: "How do you know where all our fault planes and solution cavities are?" The answer, of course, is that they are not known and if there were anybody who did know he would be a decidedly valuable and busy individual.

One can start, however, with fairly homogenous material and by making different sized openings and varying cover get data of some value to the industry. From this one may go to shattered material and to making models of different strata. It is possible to go still farther, apply the mechanics now known and try various designs of openings so that the material above would shatter in different sorts of ways.

Most of what is here mentioned has been tried with results that, from a mining point of view, are very interesting and offer much promise.

It is very reasonable to assume, with the increase in the number of mines working large ore-bodies of low grade, that facts concerning the behavior of the materials are becoming more and more important. The two most likely places to ascertain these facts are in the field at high expense and in the laboratory by means of models at comparatively low cost.

The sooner the preliminary experimental work having to do with the development of apparatus and means of measurement is accomplished the sooner will the laboratory be in a position to furnish the mining industry with facts on which reasoning may take place for the reduction of cost, and increased profit and safety in mining.

The term mining laboratory should be applied to a place fitted for investigations concerning the physical laws that control the behavior of earth, rock and ores under conditions of stress. They should be located at strategic points in the country and be centers of thought concerning the technological aspects of mining problems. It is much better to have a few thoroughly equipped laboratories than a large number of mediocre ones. The general scheme to be followed would be to first complete the building and development of one laboratory so that others may take advantage of the experience gained there. Such a laboratory is now being developed at the School of Mines, Columbia University, with the aid of Engineering Foundation.

In laying out courses of training for the mining engineer, too much attention can not be paid to the inclusion of courses in mathematics, physics, and mechanics, and in inculcating the research point of view. In model engineering, a comparatively new field is being developed for mining, although it has for some time been recognized in hydraulic and aeronautical engineering. So little of the theory regarding certain engineering endeavors is known, and the model is such a convenient method of getting the correct solution, that its importance is rapidly gaining ground. The time is not far distant when most engineering problems of magnitude will require model solution before construction begins.

The endeavor has been made here to show that model research will play an important part in the development of mining practice of the future. It is not a panacea or cure-all. It is the start of a process of truth or fact-finding which offers much promise and has proven of decided success in other engineering fields. The laboratories to carry on the work are costly and require auxiliary equipment and personnel for the making of models. The speed with which truths of benefit to industry will be discovered depends on the equipment and personnel, scientific supervision provided, and the cooperation of the industry.

Pond Creek Pocahontas Coal Corporation, Bartley, W. Va., recently installed what the belt manufacturer believes to be the largest conveyor belt ever shipped in a single piece. It is of 8-ply construction, has a 3/16-in. top cover, and measures 42-in. wide by 13/16-in. thick by 1,615 ft. long. The belt weighs 28,370 pounds. The belt is carried on anti-friction idlers, and serves to bring the coal up from the mine slope to the shakers of Pond Creek's new tipple and washery being furnished by Link-Belt Company, Chicago.

[3]Technical paper 425, A. I. M. M. E.

Long Session of Congress Closes

HAVING COMPLETED its major tasks, Congress, at midnight on July 16, terminated its session which began December 7 last, and adjourned until December 5. Out of a great mass of proposed legislation, only 506 bills were enacted. In the Senate 6,651 bills, resolutions, committee reports and documents were received while in the House the total was 15,954.

Subsequent to action by Congress in waiving assessment work on mining claims during the year ended July 1, 1932, Representative Eaton (Rep., Colo.) proposed that similar suspension be granted for the year ending July 1, 1933, but this and all other pending proposals were deferred until the next session which will terminate by constitutional limitation on March 4, 1933. Other mining measures enacted provide for a three-year extension of oil and gas prospecting permits; authorizing prospecting permits for sulphur in New Mexico; for exchange of potassium bearing lands in Tooele County, Utah, between the United States and private owners; and authorizing the Alaskan Railroad to purchase coal for its use from two or more companies operating along its line at prices to be fixed by the Interior Department. The Senate passed and the House Public Lands Committee reported a bill providing that if the Interior Department, in the interest of conservation, shall direct or assent to the suspension of operations and production of coal, oil or gas under the leasing law, the acreage rental and term of lease shall be likewise suspended. The Senate passed but House committees took no action on the following bills: for a two-year extension of sodium prospecting permits; permitting stock raising homestead entries on withdrawn oil or gas lands, but not on naval petroleum or oil shale reserves; requiring consignors of liquid fuels to make monthly reports of shipments to the Bureau of Mines to aid state authorities in making tax collections. The Senate called on the Federal Trade Commission for a report as to the dumping of foreign gasoline, particularly from Russia, in Detroit and elsewhere.

Conflicting reports were made from the House Judiciary Committee on proposed legislation for conservation of oil and gas through agreements of two or more States, approved by Congress. Representative McKeown (Dem., Okla.) author of the proposal, submitted a majority report, saying the bill "conceives a broad comprehensive and effective plan of conservation," while Representatives Montague (Dem., Va.), Oliver (Dem., N. Y.), Browning (Dem., Tenn.), and Tarver (Dem., Ga.), in a minority report declare the legislation would "confer monopolistic privileges in violation of the anti-trust laws and sound economic principles."

Coal Regulation

DIVERGENT VIEWS also developed in the Senate Mines and Mining and Manufactures Committees on proposed legislation to regulate the coal industry and for investigation of conditions in Harlan and Bell Counties, Ky. After extended hearings by a mining subcommittee, Senator Davis (Rep., Pa.) renewed advocacy of his bill for regulation of the bituminous industry through a Federal coal commission, while Senators Hayden (Dem., Ariz.) and Hatfield (Rep., W. Va.) recommended further consideration by the main committee of a substitute measure drawn by Senator Hayden and Representative Lewis (Dem., Md.) for regulation of both bituminous and anthracite. Senators Cutting (Rep., N. Mex.) and Costigan (Dem., Colo.) from a manufactures subcommittee recommended an investigation of conditions in the coal fields in Harlan and Bell Counties, Ky., while such an inquiry was opposed by Senator Hatfield on the ground that it is sought by communistic interests.

LEGISLATIVE HIGHLIGHTS

SESSION EXTENDED from December 7, 1931 to July 16, 1932.

ONLY 500 LAWS Enacted Out of 22,000 Proposals.

NUMBER OF MINING Bills Approved.

HOUSE JUDICIARY Committee Divided on State Oil Conservation Compacts.

ANTHRACITE AND BITUMINOUS Regulation Proposed to Senate Mines Committee.

KENTUCKY COAL FIELD Inquiry Favored by Manufactures Committee of Senate.

FUNDS VOTED for U. S. Participation in Monetary Conference.

BILLION DOLLAR CURRENCY Expansion On Basis of Government Bonds Authorized.

TAX REFUND INQUIRY by House Deferred By Rules Committee.

ANTI-TRUST EXEMPTION To Small Companies Suggested.

UNEMPLOYMENT RELIEF Loans Voted to States and for Self-Liquidating Projects.

VOLUNTARY OR STATE Unemployment Insurance Systems Proposed by Senate Committee.

Monetary Measures

THE HOUSE passed a resolution "to approve and encourage efforts to hold an international economic conference to consider improvement of general economic and monetary conditions," and Congress voted $40,000 to enable participation by the United States in an international monetary conference, including silver, which is to meet in London sometime this year. Representative Somers (Dem., N. Y.) introduced a bill to aid in securing a normal and stable commodity price level, through establishment of an auxiliary monetary reserve of silver and the issuance of silver certificates, under circumstances insuring maintenance of the gold standard. Under this bill $500,000,000 is authorized for the purchase of silver at from 30 to 65 cents an ounce. The Senate Banking Committee reported but the Senate took no action on a bill authorizing the purchase until July, 1938, of not more than five million ounces of silver per month at not more than 10 cents per ounce in excess of the market price. Other monetary measures introduced included a proposal by Senator King (Dem., Utah) for the use of silver as 3 per cent of reserve for Federal reserve notes; and by Representative Busby (Dem., Miss.) to reduce the amount of gold in the dollar. As a substitute for the House proposal to restore and maintain the purchasing power of the dollar on the basis of 1921-29 commodity price levels, Congress enacted a measure to permit expansion of the currency by a billion dollars by giving the circulating privilege to Government bonds bearing not more than 3⅜ percent interest during the next three years.

Rocky Mountain Institute Elects Officers

At the recent annual meeting of the Rocky Mountain Coal Mining Institute, held at Salt Lake City, L. R. Weber, president of the Liberty Fuel Company, Salt Lake City, was chosen president, and H. L. Gandy, Sheridan-Wyoming Coal Co., was elected vice president.

Shaft Sinking at the Page Mine

by Sergey E. Lavrov*

THE PAGE MINE, a property of the Federal Mining & Smelting Company, is located near Kellogg, in the Yreka Mining District, Shoshone County, northern Idaho. Yellowstone trail (U. S. Highway No. 10) and O. W. R. & N. of the Union Pacific System are situated about a mile north of the mine. A good gravel road a little over one mile and a half in length connects the Page mine with the highway. The mine road winds its way up a rather steep canyon gaining 550 ft. vertically. The collar of the shaft at the terminal of the road is 2,677 ft. above the sea level.

The shaft is inclined 50 degrees from the horizontal, is provided with 2 hoisting compartments 5 ft. by 5 ft. in the clear, and a manway 5 ft. by 4.5 ft. which accommodates a ladderway, air and water pipes, and electric cables. The shaft was sunk 600 ft. in 1906-1911 following the discovery of the ore on the property. Some drifting and crosscutting had been done, but the ore exposed was a complex mixture of finely disseminated particles of Galena and Sphalerite in quartzite gangue and was not amenable to gravity concentration. Thus several years later the pumps were pulled, the property abandoned, and in the course of a few years the mine was gradually filled with water. However, with the introduction of flotation practice, samples of Page ore were treated very successfully in the laboratory, the mine was dewatered and a 250-ton mill was constructed. Additional prospecting disclosed a parallel vein, of higher grade than the original ore shoot, and the future of the Page mine was assured.

In 1927 the shaft was sunk 300 ft. to the 900-ft. level. In 1928 an additional 300 ft. were sunk and in 1931 another lift of 300 ft. was added, making the present deepest level 1,500 ft. below the collar of the shaft, if measured on the 50-degree incline. (Vertical distance 1,150 ft.)

For the first 600 ft. the shaft had been sunk in the vein itself, but later the work was done both in the foot and in the hanging wall. The last 300 ft. between 1,200 and 1,500-ft. levels were sunk in the hanging wall. The hanging wall and the foot wall are very similar in appearance and are what is known in the district as Revett quartzite and Burke formation, both of Algonkian Age. Messrs. F. L. Ransome and F. C. Calkins describe these pre-Cambrian sediments in U. S. G. S. Professional Paper No. 62 in the following manner: Revett quartzite, "White quartzites, generally rather thick bedded inter-stratified with subordinate quantities of micaceous sandstone." Burke formation, "Light-gray, flaggy, fine grained sandstones and shales, mostly greenish, with a variable amount of purple quartzitic sandstone and white quartzite. Shallow water features throughout." The surface buildings are located around the shaft on the ground formed by excavated material from the mine workings. They are as follows: the timekeeper's office, the warehouse, the machine shop, the blacksmith shop, the saw mill, and the hoists.

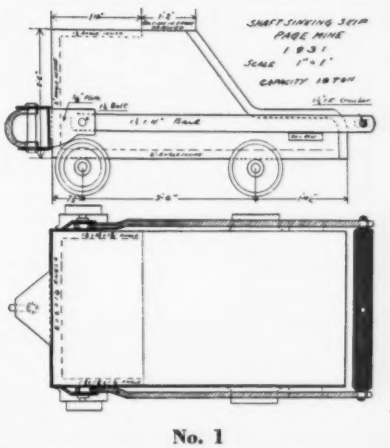
HOISTS

TWO HOISTS are in use, one on each side of the shaft. The hoist on the north side of the gallows frame is used for sinking and operating, while the hoist on the south side is used for operating purposes only.

Three air compressors of which only one or two are used simultaneously are housed in the same building with the south hoist. Their capacities are as follows: One Ingersoll-Rand 14-in. to 12-in. straight line compressor driven by Westinghouse 75 hp. motor, one No. 4, two-stage, high pressure cylinder 14¼ in. by 14 in. and low pressure cylinder 22¼ by 14 in., 1,020 cu. ft. per minute, driven by Allis-Chalmers 125-hp. motor and one Ingersoll-Rand, Criss compound, two-stage, high pressure cylinder 17½-in. by 21-in., low pressure cylinder 29 in. by 21 in., 2,550 cu. ft. per minute delivered at a pressure of 100 lbs. per sq. in. when run at 200 r. p. m. at an altitude of 3,500 ft. It is driven by synchronous motor of 465-hp. Electric bell system for hoisting and buzzers for signalling the skip are in use. The code of the state of Idaho is used. A safety overwind device and emergency bells on the gallows frame give protection against accidents. The overwind device is of a standard type, but the emergency bells are novel in design. Across the tracks on the gallows frame at the height sufficient to clear the skip are stretched 3 coiled springs. They are spaced 15 ft. apart, the last one being 10 ft. from the sheave wheel. Each spring operates through direct contact an emergency bell at the hoist. In case one is being hoisted up the gallows frame, he has three chances to grab one of the wires, or even only to stretch out his hand and merely touch the wire in order to stop the skip. This scheme was developed by Lavrov, the engineer, and Charles Fite, the master mechanic.

The gallows frame is a timber structure with two parallel tracks, dump, ore bin and waste bin. The ore bin is of 125 tons capacity and the waste bin 75 tons. A special dumping arrangement enables the hoistmen to use either skip pocket at will. The arrangement for dumping is formed by curving track rails inward to horizontal. The narrow flanged front wheels run forward on these rails, while the wider rear wheels continue up the regular slope on auxiliary rails set at a wider range beginning at a junction. Thus the skip is forced to dump its contents into the skip pocket.

Forty-pound rails are used on the gallows frame and the shaft. An ingenious device is used to lower timber and supplies into the mine. A timber boat is attached to the bottom of the ore skip by a large hook and 12 ft. of ⅞-in. cable. A section of the hinged track is lowered to connect the rails of the gallows frame, which are 50 degrees from the horizontal, with the rails on the surface in front of the collar of the shaft, which are horizontal. Then the skip and the timber boat are hoisted up above the junction, the hinged track raised to the original position, and the timber boat is lowered to the desired level, where similar provisions are made for transferring of the timber boat to the level station.



No. 1

Sinking skip which is shown on the blueprint No. 1 differs from the ordinary ore skip only in 18-in. opening in the front upper part of it, so as to facilitate the mucking operations. The skip has a capacity of 1.8 tons of rock. The timber boat provides enough room for a complete shaft set. It is also used for hoisting and lowering men. For this purpose a ladder arrangement is placed in the timber boat, so that the men sit in tiers above each other. (See picture 1.)

* Federal Mining and Smelting Co., Kellogg, Idaho.

DRILLING

THE SHAFT SINKING crew is composed of 12 men divided in three groups, four in each. The drilling crew drills and blasts, the mucking crew mucks out the round, and the timbering crew puts in the set. Only the most experienced "all around" men are selected for shaft sinking, since it was found that better results have been obtained by alternating the crews at their tasks.

The drilling crew is equipped with Chicago Pneumatic No. 5 Lyners. These C. P. 5's were converted into Jackhammers by removing the carriage and by attaching handles and changing the hammer head. Hexagon 1-in. hollow Swedish steel was used. The starter steel for casings was 24 in. long and had 2¼-in., 4 point, hammer bit. Length of steel, increase in length and decrease of diameter of the bit are given in table No. 1.

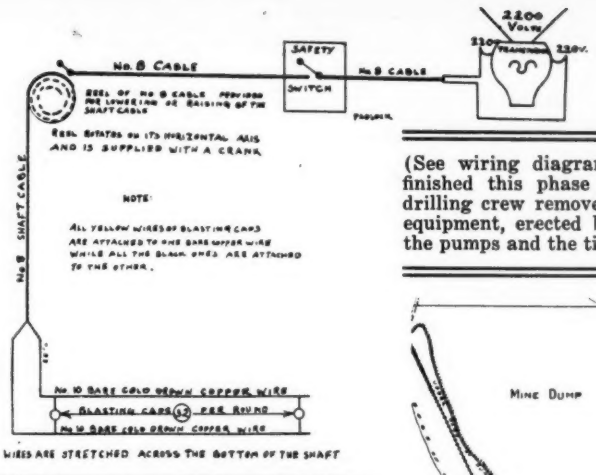
Table No. 1

Change	Length	Increase in length	Diameter of bit
1	30"	18"	2⅛"
2	48"	18"	2"
3	66"	18"	1⅞"
4	84"	18"	1¾"

To protect the holes from loose material and caving 18-in. length of scrap 2-in. pipes were used. In this case starter steel of 2¼-in. bit was used, the pipe inserted in the hole, and drilling resumed. Wooden plugs were inserted into the casings as soon as the holes were drilled and removed just before loading. Only three men did all of the drilling, the fourth man took care of the pumping, procured supplies and assisted with drilling of some back holes. The holes were spaced and blasted as shown on the sketch No. 2.

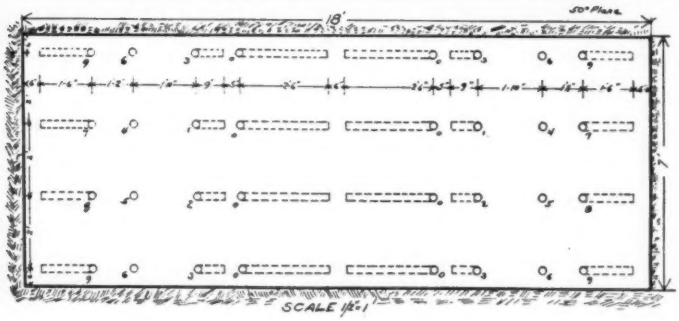
No. 2 Gelex, 45 percent volume strength blasting gelatin manufactured by the du Pont de Nemours & Co., was used. An average of 1¾ boxes per round was used. Each box contains approximately 150 cartridges, thus providing 8-9 cartridges per hole.

Delay electric blasting caps, No. 8 strength, from 0-9 manufactured by the du Pont Co. were used exclusively; 220 volts A.C. was used to fire the charge.

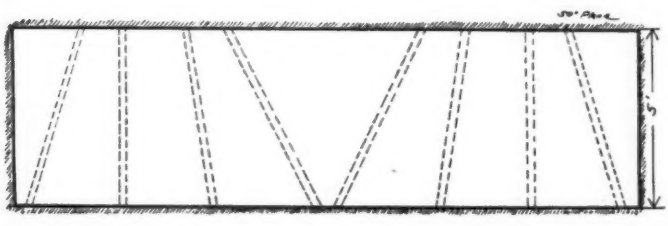


Wiring Diagram No. 1

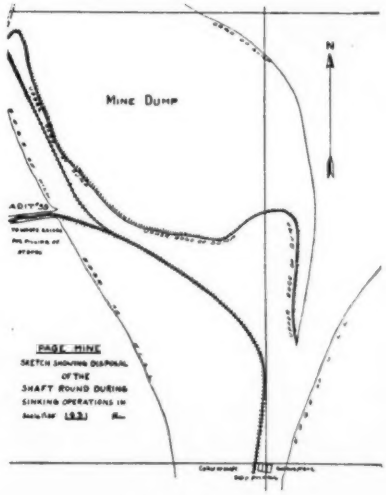
The current was taken from a transformer on the station above (every level station has storage battery chargers and transformers), and led through a safety switch to a reel for lowering the electric cable down the shaft. The reel was supplied with a receptacle to plug in the stationary end leading from the safety switch and the transformer. The reel has also a crank to facilitate raising and lowering of the cable. No. 8 cable was used. At a distance of about 25 ft. from the bottom of the shaft the cable was split. Two lengths of insulated No. 10 copper wire were attached to the ends of the cable and led to the bottom of the shaft. There two No. 10 bare cold drawn copper wires were attached to the insulated wires and stretched across the shaft. Wooden poles were used to support the wires. The wires were kept 2-3 ft. apart, and parallel to each other. After the holes had been loaded and tamped, the lead wires from the blasting caps were connected to the bare wires in the following manner: so as to avoid a chance of a possible mistake the manufacturers have the lead wires from the fuses of two colors, yellow and black in this instance. Thus all yellow leads were connected to one of the parallel wires and all the black ones to the other.



Sketch No. 2



(See wiring diagram No. 1.) Having finished this phase of their work, the drilling crew removed all of the drilling equipment, erected bulkheads to protect the pumps and the timbers, turned on the



Sketch No. 3

air, and gave a signal to the hoistmen to hoist them up to the level above. Then the pusher went to the blasting switch and turned on the current setting off the blast.

The safety switch is always padlocked and the key remains in the possession of the pusher. In order to open the box one has to unlock the door, take the padlock out of the slot, close the door again and only then the handle of the switch could be thrown up setting off the blast. This done, the pusher locks the box again and joins his men. The pumping goes on continuously. The pumps are of the Cameron vertical plunger type No. 6 and No. 7 respectively. They are air operated requiring 100 lbs. pressure and lifting 85 and 130 gallons per pump at 230 ft. head.

MUCKING

ALL MUCKING was done by hand. As the skip is in the central compartment the sides were mucked first. During the time required for the skip to make a round trip, the muck in the center compartment was loosened and skipped towards the sides thus allowing the skip to be let down each time to a lower point. The average size of the broken rock was about 3-in., the time required to fill the skip was about 3 minutes, the size of the skip 1.8 tons (see blueprint No. 1), and the time at which the skip was in motion 3.5 minutes.

The final disposal of the muck was accomplished by drawing it out from the waste bin into 32.5 cu. ft. side dump roller bearing cars, and tramming through an adit to a system of waste raises to be used in the various stopes of the mine for filling. In case no filling

(*Continued on page* 22)

Employer and employee responsibility[1]

By E. H. Denny[2]

THE LAWS of the coal mining states generally place upon the employer through the mine foreman the responsibility of seeing that mining operations are conducted safely and that all underground employes are properly safeguarded in their daily work. Some state laws also fix a responsibility upon the miners and other employes, with particular reference to keeping their working places in safe condition or equipment in a safe condition or place. There is a joint responsibility of operator and employe for safe mine operation; the operator must lead the way in safety practice, and the miner must cooperate both individually and collectively in the carrying out of state laws and safety rules and measures if accident reduction is to be attained.

The safe operation of mines is of importance not merely to comply with state laws, but particularly as a humanitarian and efficiency effort. Operators and miners are agreed upon the desirability of minimizing the loss of life and limb and the pain and suffering imposed by mine accidents; operator and miner pay dearly in decreased efficiency, increased production costs, and lessened wages because of accidents. When a compensable accident occurs the larger part of its direct cost is covered by compensation insurance which comes from employers' payments to state compensation funds or to insurance companies or direct from an individual company fund if the latter is a self-insurer. However paid, the mine operators furnish the capital for compensation payments, but in addition to this direct cost there is a much greater indirect cost of accidents which falls upon the individual operator. An analysis of many industrial accidents by Heinrich[3] of the Travelers Life Insurance Co. shows that this indirect cost amounts to four times the direct cost. Published figures show that even direct compensation costs are a considerable factor in the cost of production of coal. Thus, a report, "Coal Mine Compensation Insurance Experience in Pennsylvania, 1916-1929," by Rush N. Hosler, superintendent of the coal mine section of the Pennsylvania Compensation Rating and Inspection Bureau, shows a premium cost for the five-year period 1925 to 1929 of 3.51 cents per ton of coal mined. A recent Bureau of Mines study of coal mine accident experience in Utah[4] shows for an 11-year period that compensation premium cost has averaged 7.8 cents per ton. On considering the indirect cost of accidents to the operator it appears probable that coal mine accidents cost the coal mine operator directly and indirectly at least 15 to 20 cents per ton of coal produced. Also, if many accidents occur the operators as a whole are faced at each legislative session with a tendency toward increased compensation rates. No insurance fund can continue to pay out more than it receives. Also, there is a trend toward legislative increase in compensation payments.

The operator and the coal industry also receive the odium of mining unsafely, with consequent possible benefit in the public mind to competing fuel industries.

IN CASE of serious injury the injured miner receives his compensation which may be a small or large fraction of his monthly earnings, depending upon how fully the mines are working. If the injury is a slight one, however—less than the usual 4 or 10-day waiting period—he usually receives only medical or hospital care. Perhaps he may belong to some mutual insurance or benefit society and thereby draw weekly payments approximating his earnings during a slack period of mine production. But he and the other miners are paying completely for this protection; under insurance plans no more money can be paid out than the total paid in by all contributors, and often the losses paid out can not exceed 60 percent of the premiums paid in. In return for compensation and benefits the injured miner pays in suffering; if the injury is serious he also often sustains some permanent bodily impairment which results in lessened ability to turn out a full day's work and hindrance in finding employment in any place other than the mine in which he was injured. If the injury results in death, his family is the principal sufferer; the average man killed in mines should have had remaining about 20 years of earning period equivalent to about $30,000, for which his family will generally receive $3,000 to $6,000 as compensation.

Mining presents numerous hazards which demand coordination of effort between employer and employe to overcome a trend toward high accident rates. The extraction of coal requires that there be systematic roof support and control of roof subsidence, otherwise gravity will sooner or later result in more or less sudden filling of the open spaces, with chance of death or injury to workers. Insufficient and poorly installed timber is a major contributing cause toward the falls of roof and coal which each year kill more than 1,000 coal miners and a considerable number of supervising officials. The underground transportation of coal, whether by locomotive or by rope or by animal, is through narrow passages in coal and rock, often with limited man clearance further restricted by necessary timbering for roof and side support and with floor conditions causing or tending to cause constant troubles from rail alignment, poor joints, and consequent derailments of cars and locomotives. Electric current at 250 or 500 volts potential for trolley operation, 110, 220 or 440 volts for lighting and power purposes, and at 250 to 500 volts potential for cutting machines and drilling machines, is carried along entries traveled by men and to the face of working places in proximity to the worker, often in damp or wet surroundings and often the power lines are uninsulated or are very poorly insulated. Underground machinery may maim or kill the worker who touches a moving part. Some of it is or may be effectually guarded, but portable equipment such as locomotives, loaders, mining machines, and drills can not be completely protected. Hazards

[1] Published by permission of the Director, U. S. Bureau of Mines. (Not subject to copyright.)
[2] District engineer, U. S. Bureau of Mines.
[3] Heinrich, H. W., Industrial Accident Prevention; McGraw-Hill Book Co., New York, 1931, 366 pp.
[4] Murray, A. L., and Harrington, D., Accident Experience in the Coal Mines of Utah for period 1918 to 1929; Inf. Cir. 6530, Bureau of Mines, November, 1931, 26 pp.

such as roof falls, squeezing between car and rib, electric shock, and maiming by moving machinery would require constant vigilance to avoid injury if the full light of day were available for working; they are much increased by present conditions in most mines of entirely inadequate lighting. Some day mine lighting unquestionably will be much improved, and problems besides that of cost, such as safety from fires and gas and dust explosions, will enter into the problem of securing more efficient mine illumination.

THE EMPLOYER can do much to lessen accidents. A prominent mine operator said that his analysis of accidents showed that in 75 percent of the cases management was in some degree to blame, but in many of these cases involving fault of management the employe also had some responsibility. As in other industries, supervision by officials can do much to lessen accidents if it is directed as much toward the safety made safe by some person or persons of especial ability—frequently some person other than the man who works in the place. Safety supervision in a mine involves more than a perfunctory examination; the miner should be encouraged to test his roof properly in the official's presence, and the official in his daily visits should impress upon the miner the company's interest and the miner's own interest in safety.

Unfortunately, in most mines, supervision of the sort practiced by the railroad or the factory or the construction job is lacking; miners are scattered over a large area with visits by an official perhaps twice or sometimes once a day and some days not at all, and much of the time depend on their own experience. A recent United States Bureau of Mines study[4] in Pennsylvania showed that the average man killed in the bituminous mines of that state in the five-year period under study had 15 years of experience in mining; this gives good reason at least

SAFETY RECORDS OF CERTAIN COAL MINES IN NATIONAL SAFETY COMPETITION

Name	*Fatal accidents*	*Non-fatal lost-time accidents*	*Days lost time*	*Man-hours of operation*
BITUMINOUS COAL MINES				
1. Mine 1, Penn Central Light & Power Co., Coalmont, Pa.	0	4	39	211,760
2. Hull mine, DeBardeleben Coal Corp., Dora, Ala.	0	1	90	470,680
3. Mine 1, Seger Bros. Coal Co., Derry, Pa.	0	5	70	219,808
4. Humphreys mine, Humphreys Coal & Coke Co., Greensburg, Pa.	0	3	74	166,840
5. Dawson No. 2 mine, Phelps Dodge Corp., Dawson, N. M.	0	2	54	93,704
ANTHRACITE MINES				
1. Tomhicken mine, Coxe Bros. & Co., Jeddo, Pa.	0	47	417	458,208
2. Highland No. 6 mine, Jeddo-Highland Coal Co., Jeddo, Pa.	0	6	118	128,040
3. Beaver Meadow anthracite mine, Coxe Bros. & Co., Beaver Meadow, Pa.	0	33	820	817,072
4. Jeddo No. 4 mine, Jeddo-Highland Coal Co., Jeddo, Pa.	0	180	2,495	2,430,768
5. Highland No. 2 mine, Jeddo-Highland Coal Co., Jeddo, Pa.	0	21	493	343,392

SAFETY RECORDS OF SIX ILLINOIS COAL COMPANIES

Name	*Place*	*Number of mines*	*Man-hours worked*	*Coal produced, tons*
Superior Coal Co.	Gillespie	4	14,206,832	10,139,290
Odin Coal Co.	Odin	1	8,120,464	4,098,087
Madison Coal Co.	Dewaine	2	6,553,651	4,225,602
Peabody Coal Co.	W. Frankfort	1	4,800,370	3,276,223
Bell & Zoller Coal Co.	Ziegler	1	2,915,616	2,364,581
O'Gara Coal Co.	Harrisburg	4	2,846,898	1,843,750
	Total	13	39,443,731	25,947,533

of the workman and impressing upon the workmen the importance of safety as to the extraction and moving of coal. The Pennsylvania bituminous mining law[5] requires that "* * * no person is directed or permitted to work in an unsafe place, unless it be for the purpose of making it safe." The writer believes that if a place is found to be unsafe the supervising official should either stay in the place until it is made safe or place warning signs and remove the workers until he can make it safe, or can have it to infer that experience in mining is a poor substitute for timber in holding up rock. Conditions in a working place may change in a short time, particularly in the course of blasting or pillar-pulling operations. Also, the foreman can not watch every stage of haulage operations, so the motorman, trip rider, and rope rider must be vigilant at all times for both his own and his fellow employe's safety.

A CODE of safety rules, education of officials, and miners in safety practice, organization of officials and men in safety work, and discipline of officials and miners directed toward the full and impartial carrying out of the mine safety rules and state mining laws are also a part of a company's safety responsibility. Safety rules should be sensible and practical; if possible the men should have some say in their adoption; they should in general apply to officials and miners alike; they should include a systematic timbering system for each mine; copies of rules should be placed in printed pamphlet form and should be given to all employes; and the company should make certain that both officials and miners know and understand such portions as concern them. The purpose of disciplinary action should be to prevent the recurrence of unsafe conditions, of unsafe practices, and of accidents. The ignoring of unsafe conditions or practices for which an employe or official is responsible because disciplinary action might result in ill-feeling or in loss of wages is not justifiable; the repetition of such conditions or practices will sooner or later result in an accident with consequent suffering and perhaps death of the victim and impoverishment of his family. Ordinarily no man should be discharged until all reasonable means have been exhausted to get him to work safely in accordance with the mine rules and state laws, but there should be some penalty for thoughtlessness or carelessness. Proper supervision and discipline are the major problems of good foremanship; a good foreman is likely to get safe and efficient work through requiring an impartial observance of company rules and through securing the cooperation of his men.

Good ventilation, adequate examination of the mine for noxious gases, proper installation of electrical wiring, adequate guarding of machinery, fire protection, mine explosion prevention measures, furnishing timber, providing safe explosives, safe lighting, providing dry, safe traveling ways—these and other like problems are responsibilities of management. Their proper carrying out will assist materially in securing the cooperation of the men in safety measures; in other words, it is necessary that the management put its "house in order" and maintain it that way.

HOW CAN THE MINER share the responsibility for mine safety? He can do this both collectively and individually. If the company has a safety organization of officials and employes he should attend all safety meetings and enter the discussions and give safety suggestions. If the field is unionized the union can actively cooperate with mining companies in safety work, can make it a general practice to uphold the company officials and state mine inspectors through well-established safety rules and practices and in disciplinary measures arising out of their enforcement, it can

(*Continued on page* 20)

[5] Bituminous Mining Laws of Pennsylvania, 1921, Article 4, Section 6.

[4] Fene, W. J., How and Why Fatalities Occurred in Pennsylvania Bituminous Coal Mines during the Five-Year Period, 1926-1930; Inf. Cir. 6505, Bureau of Mines, 1931, 26 pp.

Scientific Management and Efficiency Engineering

by

G. B. Southward

"SCIENTIFIC MANAGEMENT" and "Efficiency Engineering," are two terms which have not met with general favor among mining men. This may be because the use of these two terms in other industries has been somewhat overworked in the past, combined with the fact that in certain cases their application has been carried to extremes which were beyond the limits of any practical returns. Whatever the cause, there has been a tendency, particularly during the last two years of the business depression, for mining men to take the position that efficiency and science will not bring profits to coal operations—that what the industry must have is an increased output and a higher sales price. We can all agree that these two things would bring a profit but, as the orators say, "We are facing a condition and not a theory." Today the production of coal is at the lowest point it has been for many years, as is the sales price, and while there is some hope for better conditions ahead, nobody can foresee how long the present situation will continue and to what limit the production and price will be raised when business improves.

In the meantime there are more than a million tons of coal being mined per day. This in itself is a considerable quantity of material and represents a volume of business that would bring prosperity to a large number of people and a large amount of investment if the production could be made profitable. The increasing competition from other fuel sources will continue its present pressure so that it certainly sounds more constructive to devise ways of mining coal to meet existing productions and prices than to regard present losses as a temporary condition which will be corrected automatically by improvements in manufacturing and business generally. If later improved conditions cause increased prices, so much the better.

There has already been a great deal done toward effecting economies in the operations of our coal mines but it is not correct to assume that these costs have reached an irreducible minimum. Scientific Management and Efficiency Engineering applied to a reasonable and sane degree are constructive. The impractical extremes to which these have sometimes been carried in the past should not blind us to the good that has been accomplished through their application and should not make us discredit their value for the future of coal mining. If we consider what these two terms actually mean and what they are intended to accomplish, we will find that the application of their principles will be very helpful in cost reductions. At least a number of coal companies are doing this and their example can well be followed.

It is very probable that we are passing through an evolution in coal mining—it is certain that methods which have been successful in the past are no longer profitable and it may be necessary to discard many of the old ways for new. Just how many we do not yet know, but we do know that in this evolution the "cut and try" plan is apt to be expensive. In giving up old methods we have to discard old standards and the real use for Engineering Efficiency will be to determine what new standards of performances are possible. The function of Scientific Management will be to effect these changes, based on an accurate knowledge of the results which must be accomplished regardless of what has been the tradition or standard in the past.

Coal mining—bringing the coal from the solid face underground to the railroad car tipple—involves many different items of operation. Each of these operations requires men or material, or both. Consequently, each one adds to the total cost and in considering possibilities for cost reduction it is becoming more and more necessary to analyze each operation into its various and component parts. Otherwise, opportunities for savings are certain to be overlooked, and while it is always more attractive to make a large saving in one operation, it is equally effective to make a number of small savings whose total may be the difference between profit and loss.

If we eliminate from our consideration the overhead or fixed charges, such as administration, taxes, royalty, etc., and confine our attention strictly to the cost of the underground and surface operations, we usually divide these into the following units:

1. Cutting.
2. Drilling.
3. Shooting.
4. Loading.
5. Gathering.
6. Main Haulage.
7. Tipple.
8. Track Work.
9. Timbering.
10. Ventilation.
11. Drainage.
12. Equipment Maintenance.
13. Handling Supplies.
14. Power.
15. Material and Supplies.

The cost for each of these items is usually kept separate and the efficiency of each performance is judged by its total cost. Yet each one of these units is in turn made up of a number of different operations. For example, cutting includes cleaning kerf, shovelling bug dust, tramming the machine, changing bits, delivering bits, sharpening bits and machine repair.

Each of these items costs money and the real and total cost of cutting must include the work performed and the material used for all of these—and each should be considered separately. In the same way all of the other operations in the main list of 15 cost divisions as given above can be subdivided so that a complete analysis of the total mining cost would involve consideration of perhaps as many as 100 different operations. It may not be necessary to have a cost sheet include all of these, but it is advisable to examine each operation so as to determine whether its cost is a reasonable proportion of the total or is in line with the amount of work done.

Winners of the National Safety Competition of 1931

Approximately 350 mines and quarries in 34 states participated in the National Safety Competition of 1931, and 68 large operations had no lost-time accidents. A replica of the bronze trophy "Sentinals of Safety," donated by *The Explosives Engineer* magazine, was awarded to the winning company in each group.

In the anthracite-mine group, the winner was the Highland No. 2 mine at Jeddo, Pa., operated by the Jeddo-Highland Coal Company. During 299,560 man-hours of operation this mine had but 15 accidents causing 227 days of disability, the accident-severity rate being 0.758 per thousand man-hours.

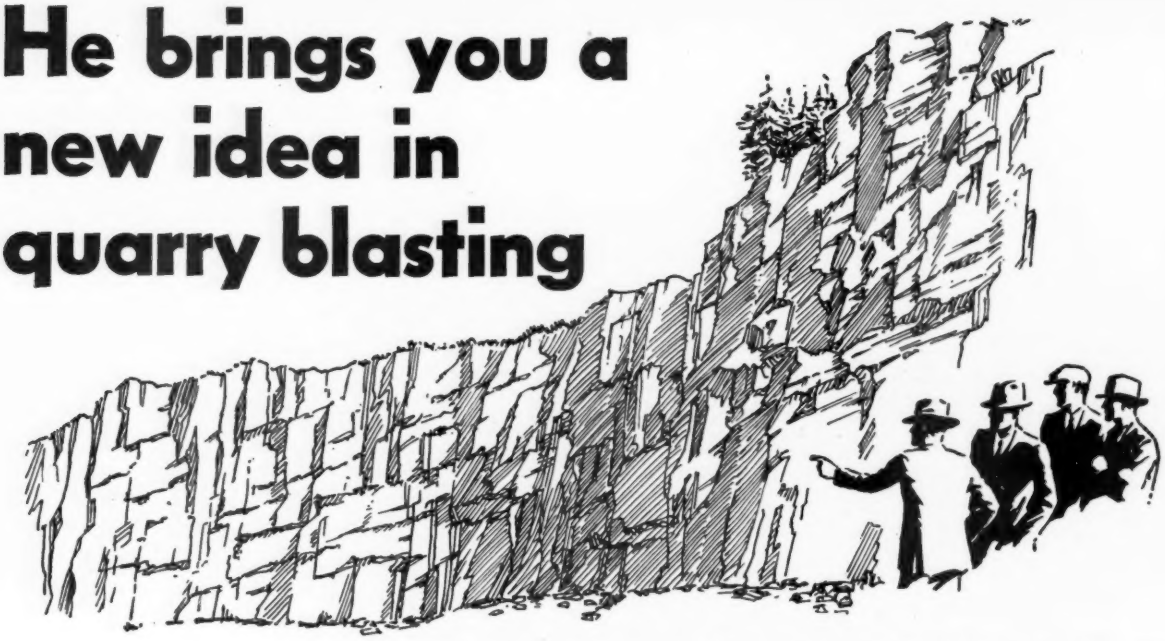
In the bituminous coal mine group, the highest award was given to the Dawson No. 1 mine, Dawson, N. Mex., operated by the Stag Canon Branch of the Phelps Dodge Corp., which had no lost-time accidents during a period of 117,661 man-hours operating time.

Of the metal mines competing, the winner was the Harold iron-ore mine, Carson Lake, Minn., operated by the Hanna Ore Mining Company. During 196,316 man-hours of operation this mine had no lost-time accidents.

In the nonmetallic mineral group first place was given to the Retsof rock-salt mine, Retsof, N. Y., operated by the Retsof Mining Company, which had no lost-time accidents during a period of 354,172 man-hours of operation.

In the group comprised of quarries and open-cut mines, the winner was the Mahoning open-cut iron-ore mine, Hibbing, Minn., operated by the Mahoning Ore and Steel Company, which operated 339,722 man-hours without a lost-time accident.

He brings you a new idea in quarry blasting



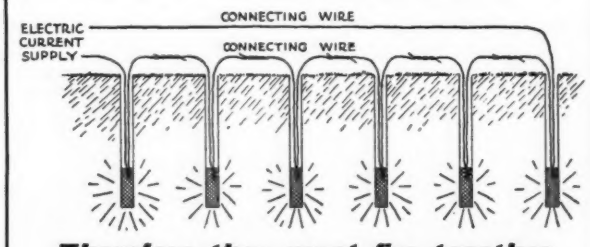
He brings a method in tune with the times—providing more satisfactory blasting at less cost. It is a scientific method perfected in the laboratory and proven by field tests. He is the Atlas representative, ready with evidence to prove the advantages of electric blasting in quarrying.

Primary action in a horizontal direction from well drill quarry charges assures toe burden disruption, good fragmentation, controlled back breaks, limited throw and less noise from blasting. The Atlas representative can prove that electric blasting will provide these benefits at a worth while saving in blasting costs. It is all due to the "team-work" secured by the use of electric blasting caps. But . . . get the complete story. . .

WRITE FOR THE FREE FOLDER,
"THEY MUST PULL TOGETHER"

Learn why slight variations in the firing of well drill hole charges increase the cost of rock production.

THEY MUST PULL TOGETHER . . .



Therefore they must fire together

Progressive firing or the firing of one charge before another produces relief to adjoining charges as evidenced by "gunning-out" or trenching action along the line of bore holes. Electric Blasting reduces this "gunning-out" action—increases the effectiveness and decreases the cost of the blast.

ATLAS POWDER COMPANY

A proper explosive for every blasting requirement

WILMINGTON, DELAWARE

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Allentown, Pa.; Boston, Mass.; Charleston, W. Va.; Denver, Colo.; Houghton, Mich.; Joplin, Mo.; Kansas City, Mo.; Knoxville, Tenn.; Memphis, Tenn.; New Orleans, La.; New York, N. Y.; Norristown, Pa.; Philadelphia, Pa.; Pittsburg, Kans.; Pittsburgh, Pa.; Pottsville, Pa.; St. Louis, Mo.; Tamaqua, Pa.; Wilkes-Barre, Pa.

ATLAS EXPLOSIVES

ATLAS EXPLOSIVES

ON THE WEST COAST WRITE THE GIANT POWDER CO., Cons., San Francisco, Cal.

NEWS
of the mining field

Personals——

C. E. BOCKUS, president, Clinchfield Coal Corporation, and president, The National Coal Association, recently presented a paper to the conference on Anti-Trust Laws, on "Anti-Trust Laws and the Coal Industry."

RICHARD F. GRANT, president, Lehigh Valley Coal Corporation, has been absent from his office on a fishing trip.

SAMUEL A. TAYLOR, mining and consulting engineer, Pittsburgh, Pa., recently spent several days on professional business at Morgantown, W. Va.

EDWARD O'TOOLE, JR., president, American Coal Cleaning Corporation, Welch, W. Va., was recently severely injured when thrown from a horse, during a vacation at one of the summer resorts.

The annual state-wide first aid and mine rescue contest will be held at Lynch, Ky., on August 20, according to an announcement by John F. Daniel, chief, Kentucky Department of Mines.

GENERAL BRICE P. DISQUE, executive director, The Anthracite Institute, was guest of honor at a luncheon of the Buffalo, N. Y., anthracite club, on July 11.

LOUIS S. CATES, president, Phelps Dodge Corporation, has returned to his New York office after a western trip which included Salt Lake City, Utah, and San Francisco, Calif.

HARRY L. GANDY, president, Sheridan-Wyoming Coal Company, has been elected a director of The National Coal Association.

THE AMERICAN MINING CONGRESS was represented by the following committee at a meeting in New York called by the National Manufacturers Association to take steps to discourage Government competition in business with private enterprises: William Loeb, vice president, American Smelting & Refining Co.; E. V. Daveler, Utah Copper Co.; Robert E. Dwyer, Anaconda Copper Mining Co.

JAMES F. CALLBREATH, secretary of the American Mining Congress, left Washington recently for a six weeks' tour of various mining centers for conferences with mining men in connection with the work of the organization. He saw mining men at Pittsburgh, Chicago, St. Louis, Denver, Salt Lake City, Spokane, and San Francisco.

GLENN B. SOUTHWARD, mechanization engineer of the American Mining Congress, has been in the field conferring with mining men in connection with the work of the Coal Division of the organization.

GUY N. BJORGE, Consulting Engineer, San Francisco, Calif., and for the past six years Associate Editor of THE MINING CONGRESS JOURNAL, is in Lead, S. Dak., for special work for the Homestake Mining Company, which will require many months to complete.

THE AMERICAN MINING CONGRESS has appointed the following committee to represent it before the American Standards Association in the development of specifications for clean bituminous coal: R. W. Arms, of Roberts & Schafer Co., of Chicago; J. R. Campbell, of Koppers-Rheolaveur Co., and Thomas Fraser, of the Hydrotator Co., of Pittsburgh.

SCOTT TURNER, director, United States Bureau of Mines, and president, The American Institute of Mining and Metallurgical Engineers, together with A. B. PARSONS, secretary of the latter organization, visited the Columbia section of the Northwest Mining Association, July 17.

CHARLES P. O'NEIL, Peale Peacock and Kerr, attended the meeting of The National Manufacturers Association, recently called at New York to discuss Government Competition with Business.

HARRY L. DAY, and his brother, JEROME DAY, Wallace, Idaho, recently acquired an option to purchase a dredge and a large tract of placer ground in the Burnt River, Idaho, district.

L. K. ARMSTRONG, mining engineer, Spokane, Wash., has published a pamphlet entitled, "Reflections on Gold and Silver." It is being given wide circulation. Mr. Armstrong is president of the Washington Natural Resources Association.

Colorado and New Mexico Association Elects Officers

Douglas Millard, manager of fuel sales, Colorado Fuel and Iron Company, Denver, Colo., was elected president of the Colorado and New Mexico Coal Operators Association, at annual meeting of that association. G. C. Davis, manager, Stag Canon Branch, Phelps Dodge Corporation, is the new vice president, and F. O. Sandstrom was reelected secretary-treasurer and traffic manager.

EMPLOYER AND EMPLOYEE RESPONSIBILITY

(*Continued from page* 16)

lead the way in the advocacy of safety measures or in their extension from one mine to another, and in its contracts with the operators it can make safety an integral part of the agreements. Individually, the mine worker can accept his responsibility by:

1. Caring for the safety of himself and others at all times.

2. Familiarizing himself with the company safety rules and state mining laws and especially with those that concern him in his daily work.

3. Carefully complying at all times with the state mining laws and company safety rules.

4. Studying current literature on safety.

The foregoing cover some of the essential features of employes responsibility, but the following are important applications of paragraphs 1, 2, and 3:

5. If a miner—testing the roof in the working place by the vibration method upon going on shift, immediately upon returning to a place after a shot has been fired, whenever a supervising official makes his visit, and at approximately at two-hour intervals during the shift.

6. If a miner—setting timber according to the company's system as soon as it is possible to place the timber, and by setting additional timber over that required by rule where doubtful or dangerous conditions prevail.

7. If a haulage employe—avoiding such practices as flying switches, jumping off of moving locomotives to open doors or throw switches, throwing of sectional switches from a moving locomotive.

8. Safe blocking of cars in dip and rise places.

9. Avoidance of horseplay in the mine.

THE ACCEPTANCE by employer and employe of the responsibility for mine accidents is lessening accidents in many mines. To October 1, 1931, 383 fewer men were killed in coal mines of the United States than in the same period of last year, representing a 17 percent reduction in fatal accidents on a tonnage production basis. In the National Safety Competition of 1930 remarkable safety records were made by coal mines awarded trophies or honorable mention, as shown in the first of the accompanying tables.

Some Illinois mines have made numerous outstanding safety records.[7] The second table shows the total manhours worked and the tons produced without a fatality at the property of six Illinois coal companies during periods for individual mines ranging from 1¼ to 22 years.

The Stewart mine,[8] W. J. Rainey, Inc., Southwest, Pa., worked from its opening in 1921 to its abandonment in 1930 without a fatal accident or a permanent total disability and during this time worked 5,000,000 man-hours and produced 4,000,000 tons of coal.

The Mather mine,[8] of Pickands, Mather & Co., Mather, Pa., operated through the entire year 1930 with 782 men who worked a total of 1,676,608 man-hours and produced 1,043,185 tons of coal without a fatality or permanent disability and with 52 lost-time compensable accidents.

The United States Bureau of Mines has on file numerous other similar good records showing that mine accidents can be considerably reduced where mine management and employes work together on safety.

SUMMARIZING, the mine operator and in some cases the miner has a recognized legal responsibility for coal mine safety; where both operator and miner give more than a perfunctory recognition of such responsibility and cooperate in working earnestly toward safety, mine accident reduction follows. The operator can secure the cooperation of the men only by leading the way in safety practice. The miners individually and collectively must actively support state and company safety measures if they are to be enabled to work in mines with reasonable immunity from accidents. Numerous mining companies have demonstrated that good safety records can be achieved. Both the miner and the operator can gain financially by accident reduction; and when the operators and miners fully accept their responsibility for mine accidents and work accordingly toward their reduction, there will be a great reduction in the present yearly coal mining toll in lives and suffering.

[7] Miller, A. U., Some Safety Records in Illinois Coal Mines; Inf. Cir. 6417, Bureau of Mines, April, 1931, 23 pp.

[8] Holmes Safety Chapter Notes, April, 1931, U. S. Bureau of Mines.

With the MANUFACTURERS

John A. Roebling's Sons Company, Trenton, N. J., have recently released their new "Roebling Wire Rope Splicing Book," copies of which are available upon request to their home or branch offices.

A general purpose photoelectric relay that provides more sensitive control than the models which it supersedes and at the same time will permit operation at a minimum light intensity of three foot-candles, has been developed by the General Electric Co.

Sullivan Machinery Company, 400 No. Michigan Avenue, Chicago, has just issued a new loose leaf catalog of its equipment, parts and supplies, used in connection with hammer drills in mines, quarries and on construction work.

The Oxweld Extensometer, a new testing device which makes it possible to determine the yield point of specimens being tested in an Oxweld Portable Tensile Testing Machine, has been announced by The Linde Air Products Company, 30 East 42nd Street, New York, N. Y.

The Southwestern Interstate Coal Operators' Association has moved its general offices from Kansas City to the Globe Building, Pittsburg, Kans.

New Bronze Welding Rod Introduced

A new bronze welding rod, known as "Oxweld No. 25 M. Bronze Patented Welding Rod," has just been introduced by The Linde Air Products Company, 30 East 42d Street, New York, N. Y. Because of its special characteristics this improved manganase bronze rod is unexcelled for use in the rebuilding of wear-resisting surfaces such as piston rings or cylinder walls. Besides producing weld metal with superior wear-resisting qualities, this rod has the added advantage of being non-fuming and exceptionally free-flowing.

It is possible to remelt and reweld welds made with this welding rod with an ease heretofore considered impossible with a bronze welding rod. This rod is particularly effective for use in the sectional building-up of large pieces, where the weld must be made in successive layers, because there is no heavy slag formed over the weld after it has cooled.

A new time starter has been designed by the Westinghouse Electric and Manufacturing Company for mining service for use with non-reversing, constant speed direct current motors on pumps, fans, hoists, all kinds of conveyors, loading machines and all types of mining machines.

Final tests have recently been completed on a new type of magnetic separator which has been designed to combine great capacity with a separating intensity heretofore considered unattainable. The results announced by the Dings Magnetic Separator Company laboratories in Milwaukee specify that the machine, designated as Type IR, has performed the following operations: Removed slate from coal, mica from feldspar, iron oxide from bauxite, dolomite from gypsum, oxides of iron and imbedded oxide particles from silica, sand, etc.

Innovation in Circuit Protection

For circuit protection in mines, buildings, industrial plants—in fact, wherever electricity is used—a safe, flashless device has been developed to perform the function heretofore left to carbon circuit breakers or fuses. It is known as the AB "De-ion" circuit breaker and is a development of the Westinghouse Electric and Manufacturing Company.

J. Vale Downie has resigned as advertising manager of Keystone Driller Company. The Frank Presbrey Company handle all Keystone advertising.

INDEX TO ADVERTISERS

SHAFT SINKING AT THE PAGE MINE

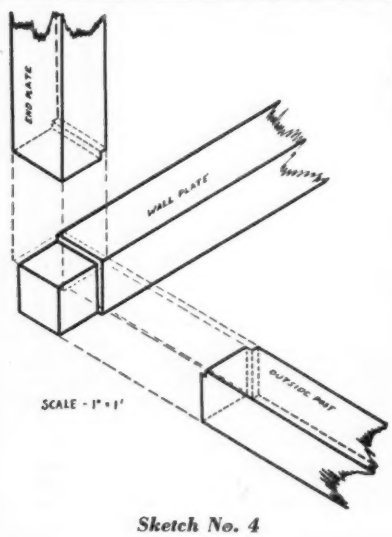
(*Continued from page* 14)

was needed the waste rock from the shaft was simply dumped at the edge of the mine dump. (See sketch No. 3.)

TIMBERING

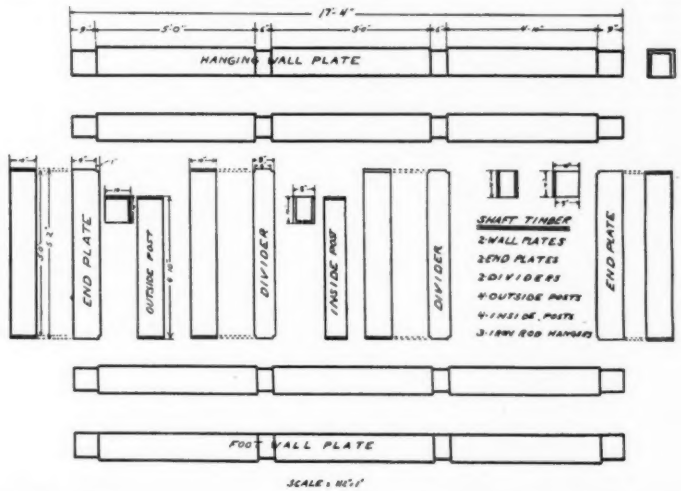
ALL THE TIMBER for the shaft is framed in the saw mill. The timbering crew loads the shaft timber into the timber boat taking particular care that the wall plates are put on right end up, as there is no room to turn the wall plates once they are lowered into the shaft. Subsequently the timber is lowered to the bottom of the shaft and put in place. Hanging and foot wall plates are 10-in. x 10-in. x 17-ft. 4-in. Two end plates 10-in. x 10-in. x 5-ft. 2-in., two dividers 8-in. x 10-in. x 5-ft. 2-in., four outside posts 10-in. x 10-in. x 4-ft. 10-in., four inside posts 8-in. x 10-in. x 4-ft. 10-in., and three iron rod hangers comprise the set. Dapping and complete framing details are shown on sketches Nos. 4 and 5.

All the timber is seasoned red fir. A chalk line and 15-ft. straight edge are used to get the approximate center line and the correct grade. When the timbers are in place and only the blocking remains it was customary for the surveyor to check the line and grade with the transit. This is done by setting the instrument at the point of the CL, which had been previously established, backsighting at the collar on the surface and plunging for the center line on the new set. Then the set is blocked until the center mark on the set coincides with the center line of the instrument.



Sketch No. 4

Sketch No. 5



The correct grade is obtained in the following manner: an ordinary 5-ft. rule graduated in inches and mounted on straight edge is used as a means of ascertaining a difference in elevations between a point of known elevation and a new set. The rule is placed at right angles to the dip of the shaft in both instances. This is accomplished by placing of the rule on the upper edge of the foot wall plate in such a manner that the top of the rule rests against the upper edge of the hanging wall plate. With vernier of the vertical circle set at 50 degrees, which is the dip of the shaft at the Page mine in this instance, the rule is placed at the point of known elevation, the reading of the rule is recorded and the rule placed on the new set. Another reading is taken and the set is blocked up or down depending upon the results of observation. When correct reading is obtained on the new set, the center line is checked again, and if satisfactory, the set is left in proper alignment. This procedure takes about 20 minutes, as the set was already in pretty fair alignment and only the last "finishing touches" were necessary. Once a week, usually on Sundays, when the shaft crew did not work, every set put in the previous week was checked by the surveyor to the line and the grade. A daily report of the progress of work and alignment was submitted by the surveyor to the superintendent of the mine.

Table No. 2

Shaft sinking costs per ft.

	1927	1928	1931
Labor	$27.23	$28.02	$27.29
Timber	4.23	5.37	4.25
Explosives	3.96	3.95	4.29
Other supplies	10.78	5.72	*4.43
Power	.50	1.18	1.27
Total	$46.70	$44.24	$41.50

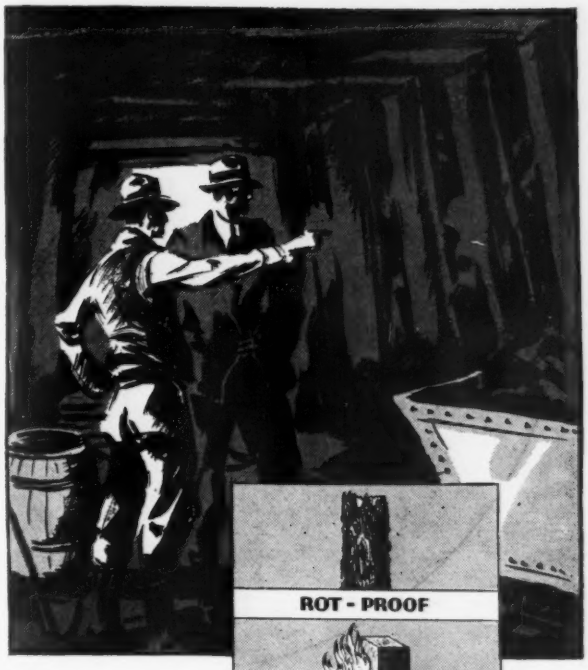
* Other supplies include:

Nails	$.11
Carbide	.06
Pick points	.10
Drill points	.52
Machine hours	.60
Miscellaneous	1.72
C. & E.	1.32
Total	$4.43

Wage scale at the Page mine shaft sinking 1927, 1928, 1931. Base pay $5.50 for shaftmen, $6 for pusher. Bonus as follows to be figured on average advance for semi-monthly period.

3 ft. per day	$1.50
3 ft. 3 in. per day	1.62
3 ft. 6 in. per day	1.75
3 ft. 9 in. per day	1.87
4 ft. per day	2.00
4 ft. 3 in. per day	2.12
4 ft. 6 in. per day	2.25
4 ft. 9 in. per day	2.37
5 ft. per day	2.50

You can cut your TIMBER REPLACEMENTS *Materially!*



MINE executives know that timber replacements cost *more* than the original installations . . . and that they can save real money by reducing the *number* of needed replacements.

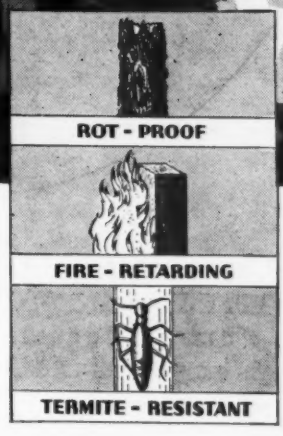
Mine timbers treated with Zinc Chloride last from 3 to 6 times as long as untreated timbers. By treating your timbers with Zinc Chloride, you can *eliminate at least two-thirds of your replacements.*

* * *

The Zinc Chloride treatment adds but little to the cost of untreated timbers to obtain this saving. It eliminates many costly replacements, reduces labor and material charges, and keeps maintenance expense at a minimum.

Zinc Chloride-treated wood is rot-proof, termite resistant, and fire retarding. It is clean, odorless, and paintable. For greatest economy, every mine timber, as well as all structural timbers, should be preserved with Grasselli Zinc Chloride.

If you are not already using Zinc Chloride-treated lumber in *your* operations, send the coupon *at once.* It will point the way towards economy.



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GRASSELLI ZINC CHLORIDE
A Positive Preventive of DECAY in Mine Timbers

Send for this free, illustrated book which explains the advantages of the Zinc Chloride treatment of wood and points the way to valuable economies in maintenance.

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Please send me, without cost or obligation, your booklet, "Looking Ahead Twenty Years in Wood Utility."

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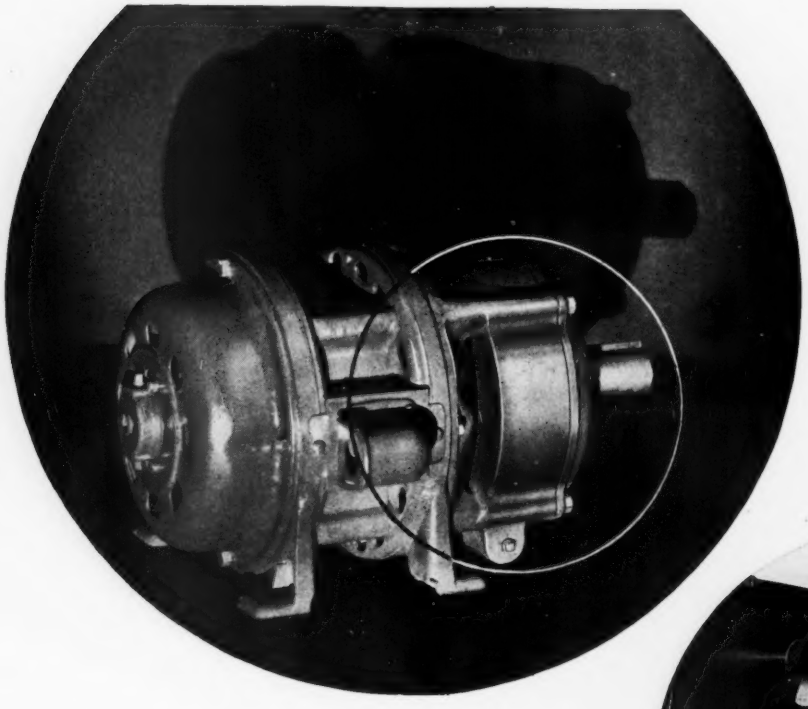
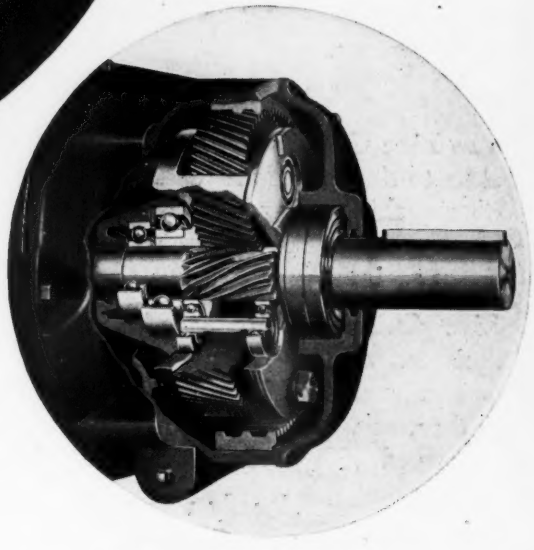
EFFICIENT - - COMPACT - - ECONOMICAL





THE G-E GEAR-MOTOR is a combination of a motor and a speed reducer, built into a single, compact unit to deliver the desired low speed, direct at the drive shaft. It is only slightly larger than an ordinary motor and is easy to install.

The GEAR-MOTOR combines the economy of a standard, normal-speed, general-purpose motor and the efficient speed reduction of internal helical gearing running in oil. The GEAR-MOTOR delivers the full rated horsepower of the motor at the output shaft.

Information on this complete line of GEAR-MOTORS can be obtained from the nearest G-E sales office or G-E Motor Dealer, or from General Electric Company, Schenectady, New York.

STANDARD RATINGS

600 to 13 Rpm.
Polyphase, 3/4 to 75 hp.
Single-phase, 3/4 to 5 hp.
Direct Current, 3/4 to 7 1/2 hp.

Other speeds and horsepower ratings can be furnished on request. Mechanical modifications are available, such as flange mounting, vertical motors, etc.

Speed adjustment can be obtained by selecting a motor with the necessary electrical characteristics.

201-229

GENERAL ELECTRIC